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Medium-term results after femoral varus osteotomy in Legg–Calvé–Perthes disease

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Background

In 2004 J. A. Herring published a multicenter study in which he presented his latest results of predictive risk factors in Legg–Calvé–Perthes disease. As we are attending a lot of children with Legg–Calvé–Perthes disease, we reviewed our data of the last 20 years for children we have treated by a femoral varus osteotomy and compared the results.

Method

Since 1986 we attended 139 patients with Legg–Calvé–Perthes disease in our department. Fifty-six patients who were just treated by a femoral varus osteotomy and which had a clinical and radiological mean follow up of 8.3 years (2.1–28.6) had been included for this study. This number of patients is equivalent to 62 hips. The aspect ratio (left–right) was equal, the sex-ratio boy/girl was 4.7/1. The mean age of diagnosis was 6.1 years (1.9–12.5) and operation was done about 7 months later. The mean follow-up time was more than 8 years with 26 hips followed up for more than 8 years. We reevaluated the X-rays of our patients with Herring and Catterall classification and measured the lateral subluxation. The outcome was evaluated at latest follow-up exam with Mose and Stulberg classification and the lateral subluxation once again measured.

Results

With our study we were able to confirm the results of J. A. Herring: a preoperative high grading in Herring or Catterall classification is often associated with poor results in Mose or Stulberg classification. An age of more than 8 years at initial diagnosis correlates also with bad results. Female hips are above average represented in poorer grading of Mose and Stulberg classification, which might be due to their non-retarded skeletal age.

The lateral subluxation, which was not considered in J. A. Herring's multicenter study is used in our department as substantial operation criteria. Our data demonstrates the evolution of a re-subluxation after operation in dependence of preoperative Catterall classification.

Conclusion

Our results show that lateral subluxation is also a substantial prognostic criterion and therefore we use it in our department as substantial operation criteria.

Dysplasia epiphysealis hemimelica (Trevor's disease): seven cases and their clinical course

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Keywords Dysplasia epiphysealis hemimelica, Clinical course

Introduction

Dysplasia epiphysealis hemimelica (DEH), or Trevor's disease, is a rare congenital disorder with asymmetrical, mostly intra- or juxta-articular hemimelic growth of atypical osteocartilaginous lesions of the epiphyses. In published literature, scarcely 100 cases are described. The epiphyses of the tarsal bones, the distal femur and the proximal tibia are most commonly affected. Boys seem to be affected more frequently than girls.

Materials and methods

Between 1999 and 2006, seven patients (4 males, 3 females) have been treated in our institution with the typical manifestation of DEH. We saw three cases with involvement of the talus, and 1 each with involvement of the distal femur, the distal fibula and the distal tibia. One patient showed lesions both on the distal femur and the proximal tibia of the same joint. Five times the right side was affected, two times the left side. The age at diagnosis of our patients ranged from 2 years 9 months to 13 years, and patients were followed for a maximum of 6 years, although two were seen only once. Presentations varied within the cohort: five patients presented with pain and were noted to have a restricted range of motion of the joint in question, two patients present with swelling of the joint, one patient showed a varus deformity of the ankle joint and one patient complained about joint blockades. Two of the patients have been free of complaints up till now.

Results

Two patients have been diagnosed by chance because of X-ray after minor trauma. Both of them are free of complaints. The five patients with discomforts were treated surgically between one and four times.

Age at time of the first operation varied from 4 to 14 years. Postoperative all five patients reported temporary improvement of range of motion and of pain intensity. One patient required three revisions (after 3 years, 3 years and 3 months, 6 years), two patients needed a revision after approximately 1 year and two patients have not yet required revision.

Discussion

Compared to existing literature, this is a relatively large cohort. We have had both asymptomatic patients and those who have needed numerous surgical interventions. In all cases with clinical symptoms, surgical procedures were necessary because of the severity of complaints.

We have been able to achieve improvement of pain and range of motion in all of the cases. With longer follow up, two patients have continued to have benefits from their initial surgery, whilst three patients had an improvement for a period of time between 1 and 3 years before having symptoms relapse.

Dysplasia epiphysealis hemimelica is therefore a disorder with high risk for relapse and it shows a highly variable clinical course making early prognostication difficult.

The treatment of severe secondary hip dislocation using resection arthroplasty including autologous capping

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Keywords Hip dislocation, Cerebral palsy, Autologous capping

Introduction

Secondary dislocation of the hip is common in patients with severe cerebral palsy. It is associated with pain and difficulties with perineal hygiene, nursing care, and positioning in bed and in a wheelchair. Progressive dislocation with severe deformities of the femoral head and acetabulum requires extended surgical treatment including palliative procedures like proximal femoral head resection. This resection arthroplasty is effective to reduce pain and seating difficulties. However, a high rate of heterotopic ossification was observed following this procedure. This study demonstrates a new method using autologous capping during resection arthroplasty in order to reduce the rate of heterotopic ossifications.

Materials and methods

Eight patients (age 16–37 years) with cerebral palsy and severe spastic quadriplegia have been treated for painful hip dislocation with seating difficulties. The hips were all treated with resection arthroplasty and additionally received autologous capping of the femoral cutting end. Following osteotomy of the femur diaphysis distal to the lesser trochanter the proximal fragment is subperiosteally disengaged from all inserting muscles. The femoral head is cut off the proximal fragment, a groove is created at the cutting surface of the head and the capping graft is then put over the femur stump. Two cerclages are passed through small drill holes in the diaphysis and the head to fix the graft on the proximal femur. The acetabular cavity is sealed off by oversewing the capsular edges and the gluteal muscles. The patient is placed in skeletal and skin traction for 3 months.

Results

At time of discharge all patients were fully able to seat and significant reduction of pain was observed. Deep wound infection was found in one patient and removal of the autologous capping was necessary.

Discussion

Palliative operations including resection arthroplasty are restricted to failed reconstruction operations or severe luxations, and are

performed to attempt pain reduction or the facilitation of perineal care. A new surgical technique was developed in order to decrease the rate of heterotopic ossification after resection arthroplasty. Radiotherapy or autologous capping using bone grafts from the iliac crest are also used to prevent ossifications but are associated with additional morbidity. Severe deformities of the femoral head are often seen and don't represent a contraindication for autologous capping. The first results show pain relief and increase of range of motion. Further investigations are needed to determine the effect on the rate of heterotopic ossifications.

Radiological evidence for femoroacetabular impingement 10–20 years after K-wire fixation in mild slipped capital femoral epiphysis

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Keywords Slipped capital femoral epiphysis, Femoroacetabular impingement, Long-term follow-up

Introduction

From the fact that osteoarthritis of the hip joint secondary to slipped capital femoral epiphysis (SCFE) is to be expected especially in cases with slip angles greater than 30°, it is deduced that in mild SCFE, i.e. those with a slip angle less than 30°, fixation of the gliding epiphysis in situ with K-wires or screws is sufficient. This assumption is challenged by the intraarticular observations recently made by the Bernese group, showing severe damage to the labrum acetabulare and adjacent acetabular cartilage very early after onset of symptoms. In an attempt to find proof for the Bernese group's recommendation that the anatomy at the femoral head–neck junction should be restored by an osteochondroplasty, we evaluated those patients clinically and radiologically, who had received an in situ fixation of both femoral epiphyses 10–20 years ago, when a unilateral slip of less than 30° had been present.

Materials and methods

From October 1984 to December 1995, 44 patients with mild unilateral SCFE were treated with a bilateral in situ K-wire fixation. Of these, 28 patients could be contacted and 18 evaluated. On clinical evaluation, range of movement of both hip joints was registered and the so-called “impingement provocation test” (forced internal rotation in 90° flexion) was performed. Radiological evaluation consisted of AP radiographs of the pelvis and lateral “cross-table” radiographs of both hips. Statistical significance was examined using Wilcoxon's matched-pairs signed-ranks test, Fisher's exact test and Chi-squared test for independence, according to the characteristics of the investigated data. The level of significance was set at $p < 0.05$.

Results

There were statistically significant differences for internal rotation and abduction between affected and unaffected hip joints [$15^\circ \pm 7.9^\circ$ vs. $21^\circ \pm 7.9^\circ$ ($p < 0.01$) and $37^\circ \pm 7.7^\circ$ vs. $42^\circ \pm 6.7^\circ$ ($p < 0.01$)]. The impingement provocation test was positive in four and six hips, respectively ($p = 0.71$). Significant differences for the head–neck ratio ($p < 0.01$) and for the presence of bony prominences ($p < 0.01$) were found in the radiographs. Angle α according to Nötzli et al. (2002) was significantly different between affected and unaffected hips in the AP pelvis radiographs ($84^\circ \pm 10^\circ$ vs. $60^\circ \pm 15^\circ$, $p < 0.01$), but not in the lateral “cross table” radiographs ($50^\circ \pm 8^\circ$ vs. $48^\circ \pm 11^\circ$, $p = 0.3$).

Discussion

Regarding the clinical findings, in situ fixation of the gliding epiphysis seems to be acceptable, especially when appreciating the little

invasiveness of this procedure. Radiologic evaluation, however, supports the notion that an osteochondroplasty at the femoral head-neck junction might be sensible in order to prevent or delay femoroacetabular impingement of the affected hip joint and with it osteoarthritis secondary to SCFE.

Treatment of knee contractures with the Ilizarov fixateur

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Several methods have been used for treatment of knee contractures. The disadvantages of soft tissue procedures (e.g. muscle lengthening) are loss of muscle strength. Furthermore it may not be possible to correct the whole deformity. The Ilizarov method achieves full correction of deformity without loss of muscle strength.

Twenty-one patients with 34 extremities at a mean age of 11.6 years (5.3–18.2 years) have been treated for knee contractures with an Ilizarov fixateur. A total of 26% ($n = 9$) had been treated by soft tissue or bony surgery prior to this procedure. The majority of patients were suffering from arthrogryposis ($n = 7$, 12 knees), myelomeningocele ($n = 5$, 8 knees) or cerebral palsy ($n = 4$, 7 knees). The average time to achieve full correction was 2 months. The complication rate of the Ilizarov method was 46%, with pin tract infection being the major problem (20%). Secondary surgery was necessary in 20%.

After treatment the majority of patients (66%) was able to walk. Before surgery the average loss of extension was 38°. At removal of metal it was 1° and increased to 26° 5 years after surgery. The results were significantly better in children with arthrogryposis than in children with myelomeningocele or cerebral palsy.

We conclude that the Ilizarov method for treatment of knee contractures had a high complication rate of 46%, which made 20% of secondary surgery unavoidable. A 40° loss of extension could be corrected within two months. Despite the complication problem the method seems to be favorable for children with arthrogryposis where a permanent joint correction can be achieved without loss of muscle strength.

Borderline cases in the treatment of surgical treated clubfoot relapses with the Ponseti method

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Keywords Clubfoot relapse after surgical treatment, Pirani-score, Movement in ankle joints, Ponseti method, AFO

Introduction

The Ponseti method is the primary and the most effective treatment in the therapy of clubfoot deformities all around the world. We see a lot of relapsed cases of surgical treated clubfeet in our hospital.

The most frequently applied corrective treatment is another surgical therapy, a second or third peritalar release. With surgical treatment, the ligaments and joints will become more stiff and there will be lesser mobility in the ankle joints. It is very important to find an alternative treatment for clubfeet relapses.

Method

In our hospital we started to treat relapsed clubfeet with the traditional method of Ponseti, which is usually used for the treatment of congenital clubfeet. We always start with the first position and try to get more and more abduction in the forefoot. First of all we put white plaster cast in over-knee position. To enable the children to walk we tape scotch-cast over the normal plaster. We treated children in the age from 2 to 4 years. We needed four up to six casts in all cases. Before the treatment, the Pirani-score ranged from 2.5 to 4. Nine feet from five children were treated and photo documentation was done in every follow up.

Summary/results

All feet were corrected and got more abduction in the forefoot. The feet were completely corrected in adduction and excavatus, but not completely corrected in the equinus. After the treatment with the Ponseti method, the Pirani-score ranged from 1 to 1.5. All feet lost a lot of stiffness and pain but had an increased mobility in the ankle joints.

Discussion

The Ponseti method is also a comfortable treatment in cases with relapsed clubfeet treated with surgical methods before in a usual way (peritalar release). All relapses of the nine feet were completely corrected in adduction and excavatus but not completely corrected in the equinus position. Every foot lost the pain they had before completely and could wear shoes more comfortable. With the Ponseti-treatment used in cases with relapsed clubfeet after surgical therapy, a second and third operation could be prevented in all cases. Due to the combination of plaster- and scotch-cast, all the children were able to walk and to stay on their feet in their everyday life.

Indications for combined external fixation and intramedullary nailing in children: a case series

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Keywords Deformity correction, Elastic stable intramedullary nailing, External fixation, Osteogenesis imperfecta, Femoral hypoplasia, PFFD, Congenital pseudarthrosis of the tibia

Conventional deformity correction and leg lengthening using external fixators can be difficult even in experienced hands, especially in the presence of abnormal bone. Bone quality and stability is often compromised at the time of external fixator removal in children with PFFD, congenital pseudarthrosis of the tibia or osteogenesis imperfecta.

Herzenberg, Paley et al (2003) suggested a combination of external fixation and intramedullary nailing for stabilizing congenital pseudarthrosis and Saldanha et al (2004) published his experience using this technique in children with osteogenesis imperfecta. We decided to apply this combined technique to increase stability, avoid fractures after removal of the external fixator and maintain an achieved correction.

Materials and methods

We first used this combined technique in January 2004 in the clinic in Aschau. We have included 19 patients in this case series so far. We used this technique in 7 cases of PFFD, 4 cases of OI, 6 cases with congenital pseudarthrosis of the tibia and 2 cases of delayed union with other diseases. In 3 cases we applied external and internal fixation at the same procedure. In 16 cases we introduced the intramedullary nails at the time of external fixator removal. We did not remove intramedullary fixation before the end of the growth period.

Results

No child sustained a fracture after removing the external fixator at a mean follow-up time of 27 months (10–36). Intraoperative problems

included difficulties introducing the nail (e.g. in cases with a narrow or obliterated medullary canal), in one case it was not possible to introduce a nail.

We had one case of osteomyelitis that healed uneventfully after nail removal without fracture. In five cases we had to shorten the nails' ends because of soft tissue irritation.

Discussion

Fractures after removal of external fixators are a well-known complication in children with certain diseases. The combination of external fixation and intramedullary nailing is a safe option to increase stability. We found no fracture in our case series after removal of the external fixator, however, we cannot present any long-term results. It is not clear if the combination of external fixation and intramedullary nailing significantly increases the risk of osteomyelitis. In our case series this technique proved to be safe providing additional stability and fracture risk reduction in difficult cases.

Abstract zum VKO-Kongress 2007 Düsseldorf: “Investigation into Changes of Indirect Kinematics in Postsurgical Clubfeet”

A gait analytical pedobarographic comparative study of changes in the roll-over process of healthy and deformed feet in 6–8 years old

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Keywords Clubfoot, Pedobarography, Talus deformity

Introduction

In the past decade aggressive corrective peritalar release surgery in type III/IV Dimeglio clubfeet has produced criticism due to unfavourable results with regard to postoperative stiffness and bone deformities. Although the postoperative results seem acceptable at first sight, functional results did not always fulfil the desired criteria; in particular the roll-over process from heel contact towards toe-off seemed compromised. Short foot length together with a more supinated midfoot and toe-off roll-over phase characterized those operated feet, which clinically presented stiffness and a flat-top talus deformity. Three-dimensional dynamic kinematic data in the child's foot are difficult to obtain as marker positioning is challenging. Readily available pedobarographic insoles to measure rapid pressure changes during gait give sufficient indirect kinematic data and register relative pressure changes during the roll-over process. This enables the clinician to compare pedobarographic and indirect kinematic data of postoperative clubfeet with data acquired from healthy subjects.

Materials and methods

Twenty-five children between 6 and 8 years (f: 14/m: 11), who had clubfoot surgery at the Paediatric Orthopaedic Department at 6 months of age. All children had a one-sided conservatively pretreated severe clubfoot (left: 9/right: 16) Dimeglio III/IV that underwent a standardized peritalar release (2 surgeons) according to the protocol described by Turco (n:18) and Crawford (n:7). In this study the major steps of these different protocols were considered equivalent. Nine of these children later underwent an additional transfer of the anterior tibial tendon towards the IV metatarsal.

These children underwent visual and pedobarographic gait analysis with a wireless 64-pressure-sensor 60-Hz system; all had standardized foot X-ray. A control group of 20 clinically healthy feet rendered so-called normal pressure distribution data.

Results

Children with a favourable clinical outcome presented gait and pressure distribution data attributed to plano-valgus deformities

(n:16), whereas those with high degree of stiffness (n:7) qualified with a shortened COP line, a relative hindfoot varus and a lateralized toe-off. X-ray demonstrated various degrees of talar deformities in those seven stiff feet, which were characterized in detail. Only two post-surgical feet presented the known adult pressure distribution pattern. Data from the control group surprised with a high degree of variation and although clinically normal, foot pressure patterns from highly supinated to plano-valgus were observed.

Discussion

Functional insights into the postsurgical clubfoot mechanics and indirect kinematics are easily available with pedobarography and comparable functional evaluation is at hand. Valid data of healthy children though present a high degree of variation—sometimes suggesting pathology even in the superficially as normal classified foot—which requires a further defining process into what is the normal functional range of a child's foot.

Abstract: Primary 3-D-correction in a modern TLSO as the most important prognostic factor in conservative scoliosis treatment

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Introduction

Due to widespread pessimism towards conservative brace treatment of idiopathic scoliosis (IS), there is a general call for better clinical evidence in the evaluation of treatment results. Especially, as surgical options are aggressively promoted and indicated by keen surgeons and companies.

The abundant options of conservative IS treatment as a highly interdisciplinary concept still suffer up to date of many poorly controllable factors that have immense impact on the outcome; thus, conservative IS treatment quality may vary considerably. Indication of IS treatment, the patient's compliance, sophisticated TLSO design and the right physiotherapy are still far from being common sense. To avoid overblown expectations in the conservative IS treatment of patients and their families and to protect adolescents of frustrating treatment periods, a realistic prognosis of the proposed treatment path has to be defined after 4–6 months.

Methods

Thirty-four female IS patients with defined curvatures (n:22 type King III and n:12 type King I), expected further skeletal growth of >2 years were braced with the latest active TLSO (Cheneau) for an average of 21 h a day. X-ray control at 4/12/24 months in the brace in two planes. With each patient, the fitting of a new brace was at least once—usually at mid-term—necessary due to further growth of the patient. Initial Cobb angles ranged between 30° and 60° thoracically and 20°–45° lumbally. A typical physiotherapy programme recommended by the DGOOC is proposed and prescribed, but neither the patients compliance to wear the brace nor the physiotherapy programme is under controlled evaluation.

Results

Once the primary 3D-correction after 4 months of brace treatment and physiotherapy programme valued more than 40% (n:17 King III and n:9 King I curvatures), these improvements could be maintained or even improved during the next 20 months. The patient's compliance and their family support could be improved through this first success. With a primary correction <40% (n:8) in the brace, we observed a continued further loss of initially achieved improvements from the initial Cobb angle at treatment start towards the end of skeletal growth.

Summary

In well-defined IS curvatures, the primary 3D-correction in a modern TLSO after 4 months is believed to be a reliable prognostic parameter for the conservative treatment potential. The interdisciplinary ortho-team together with the patient's family have thus a reliable tool at hand to decide whether to continue a successful and optimistic treatment start or to quit a less favourable course of progress. The often debated questions whether a treatment failure is attributed to a non-functional brace, to missing patient's compliance or to other characteristics of IS, are not of primary interest in this context.

Tumorous calcinosis and chronic, recurrent, focal osteomyelitis—coincidence or association?

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Introduction

Idiopathic tumorous calcinosis is a rare benign disease of the peri-articular tissue near large joints and leads to deposition of hydroxyapatite in single or multiple pseudocysts and simultaneously to hyperphosphataemia. Secondary the disease leads to symptoms by affection of adjacent structures. The etiology of this disease is not definitively clear.

Case report

We present the case of a 11-year-old Turkish girl with a well-known chronic recurrent multifocal osteomyelitis (CRMO) at the upper and lower limb and hyperphosphataemia. She developed a tumorous calcinosis around the left hip, which recurred after surgery. Further she developed a tumorous calcinosis around the ankle joint.

Conclusion

The present case underlines the findings documented in the reviewed literature. Tumorous calcinosis and CRMO can appear associated. In conclusion for clinical practice a tumorous calcinosis should be excluded, when the diagnosis of CRMO and hyperphosphataemia is made.

Prospective, clinical trial of a resorbable tricalcium phosphate bone substitute (CERASORB®) in children and adolescents

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Introduction

As alternatives to the golden standard autologous bone graft, a variety of synthetic bone substitutes are currently in clinical use. These bone substitutes should be biocompatible, resorbable, effective and not expensive. Aim of our study was to examine the osseointegration of the applied bone substitute (CERASORB®) under clinical conditions. Methods: β -tricalcium phosphate (Cerasorb®) granulate, in some cases used for augmentation of autologous bone graft, cubes and wedges were implanted in 15 cases in different indications (e.g. cysts, osteotomies). Osseointegration and resorption were evaluated by clinical and radiological examination.

Results

Side effects, like infection, inflammation or incompatibility were not documented during or after implantation. Complete filling of the

defects could be achieved without any complications. Consolidation of the bone defects was shown in all cases. Augmentation with autologous bone graft increased the resorption of the material and enhanced bone recovery.

Conclusion

The examined bone substitute is useful for the filling of osseous defects. After complete resorption of the material, a complete bony recovery was achieved. Especially in large bone defects, the amount of autologous bone graft is sometimes not sufficient. In these cases augmentation with this bone substitute may be a solution.

Perthes disease in children under the age of two

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Introduction

Perthes disease is a aseptic necrosis of the femoral head in children with an prevalence of 1:1,200 and a cumulated onset between the age of 5–7 years. In the reviewed literature some cases in younger children are also documented. Latest publications showed cases with onset of this disease at the age of 17- and 18-month-old infants.

Case report

We report the case of a 13-month-old boy, which was presented with left-sided limping after commencement of walking at 8 months. Radiological examination showed reduced height and fragmentation of the femoral head. No secondary causes mentioned in literature to explain these findings could be evaluated. Magnetic resonance imaging with gadolinium-enhancement showed avascular necrosis of the lateral aspect of the femoral head. Further the MRI-scan showed an oedema of the femoral head and the metaphysis. Follow-up was done after 3 and 7 months by clinical and radiological examination. No restriction of movement and regular gait was detectable. Plain radiography showed femoral head in state of reparation.

Conclusion

This is the youngest documented case of LCPD at the age of 13 months. We want to point out to think about LCPD as a differential diagnosis in very young children with a painful limp.

Gait analysis before and after musculeshortening

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Keywords Gait analysis, Muscleshortening

Introduction

According to the concept of a short agonist being coupled with an overly long (and therefore weak) antagonist, since 7 years we shorten tendons of functionally long muscles. In the present study, patients who underwent one or more tendon shortenings at the lower extremity, underwent full instrumented gait analysis pre- and postoperatively to evaluate the kinetic and kinematic impact of the operations. In addition, the postoperative data were compared to gait analysis of a healthy normal population.

Methods

Twenty-eight patients (age 8–49 years, mean 16.75 years) underwent 44 shortening operations (16 patella tendon, 6 quadriceps tendon, 14 tibialis anterior tendon, 8 Achilles tendon). Three out of these patients



Fig. 1 Cysts in the lateral femoral condyle

had more than one shortening operation on the same extremity. The follow-up time was 1 year.

Results

Both kinetics and kinematics were positively affected by the shortening operation, the patients gait drew near that of a healthy normal population. We present first results of this method.

Discussion

Shortening operations on muscles of the lower extremity are an efficient method, according to gait analysis and exact identification of the problem, to increase muscle strength and positively influence gait.

Cystic lesions in the lateral femoral condyle of an 11-year-old boy – of tumorous, parasitic or traumatic origin? 4 1/2 year follow-up

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Keywords Lateral femoral condyle, Cystic lesion, Osteochondral flake fracture, Defect filling with cancellous bone, Cartilage sutures, 5–0 Coated Vicryl, Hoffa or Busch fracture

Introduction

In August 2002, an 11-year-old boy was presented with pain in his right knee. Radiographs had revealed multiple cystic lesions of the size of a cherry stone with surrounding sclerosis in the lateral femoral condyle (Fig. 1).

He remembered that this knee had been painful after having been fouled during a soccer match in summer 2001. X-rays at that time had not shown any fracture. He had gotten back to playing soccer after two weeks. In May 2002, he had been involved in another clash and had had more pain in his knee for a longer period of time.

MR and CT imaging showed the cystic lesions in the lateral femoral condyle more clearly (Fig. 2a, b) and the diagnosis of enchondroma or chondroblastoma was put forward. In addition a parasitic infestation was taken into consideration. Little attention was paid to a dorsal subchondral gap (Fig. 2b).

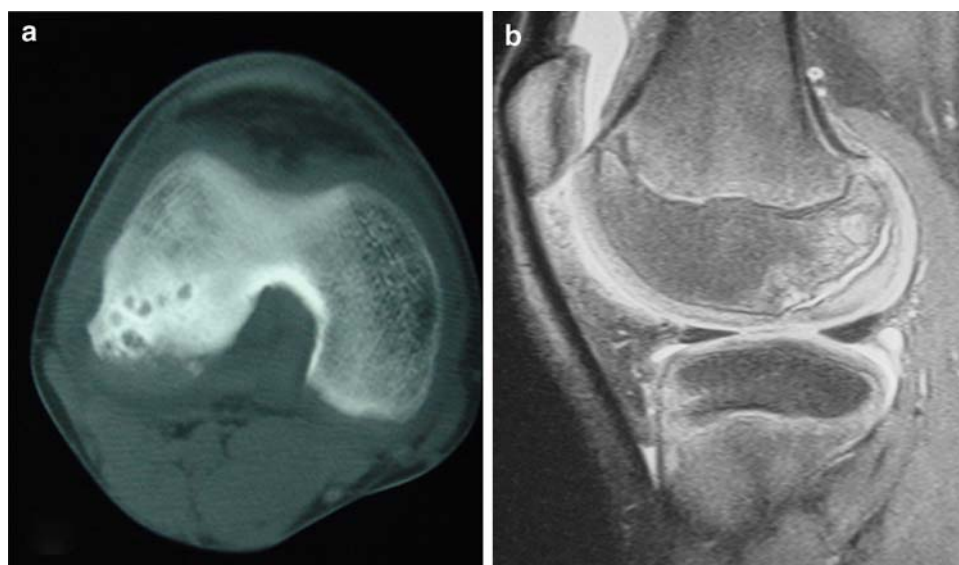
A diagnostic arthroscopy was performed and a severe cartilage lesion diagnosed. Referral to us for unclear cartilage damage and porosity of the bone.

A synopsis of all the findings led us to suspect an inveterate osteochondral fracture of the lateral femoral condyle (Rubin 1998) and the decision for surgery was made.

Operation

Postero-lateral approach in prone position. At first normal cartilage was encountered, and then, proceeding antero-laterally, a fissure was opening up. Examination with a hook revealed a cartilage shear fracture, involving almost half of the condyle. In the posterior region the large flake was well fixed. Anteriorly, there was instability. That

Fig. 2 **a** Cysts in CT image, **b** cysts and subchondral gap in MRI



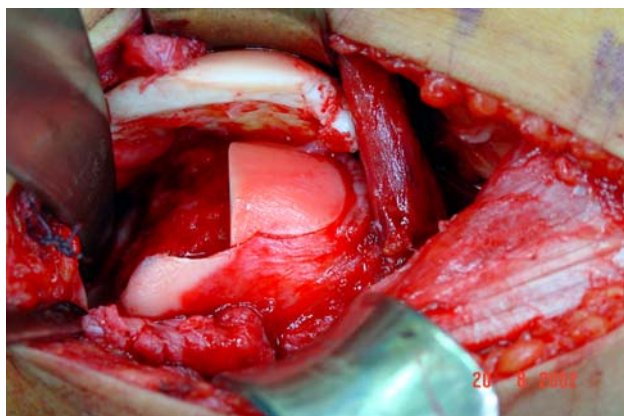


Fig. 3 Transverse sectioning of the thick dorsal cartilage and complete flipping of the fragment to the side

was where the cystic osseous changes were situated. They could not be reached easily. Decision to completely flip the fragment to the side. For this purpose, the thick dorsal cartilage was sectioned transversely (Fig. 3). Now the cystic and fibrotic bone could be well visualized and was completely removed. The large defect was filled up with cancellous bone from the posterior iliac crest (Fig. 4). The large osteo-cartilaginous fragment was put back into place after having been debrided on the inner side and at the margins. Fixation by interrupted sutures with 5-0 Coated Vicryl (Dhawan and Hospodar 1999). This was only possible on the posterior and lateral side (Fig. 5). Therefore, the patient was turned over in supine position, and suturing was completed via an anterior approach (Fig. 6, 7). In addition a loose body of the size of a bean was removed.

Aftercare (with the aid of serial MR examinations): Fitting of a Mecron-splint in almost complete extension. Non weight-bearing for 3 months. After 4 weeks begin with active assisted range-of-motion exercises: 0°–0°–30°. After 4 months, gradual increase of range-of-motion with additional use of a continuous passive motion device. Full weight-bearing after 6 1/2 months.

Result after 4 1/2 years: no restrictions in daily life. Plays soccer in the centre forward position and practices light athletics (100 m in 11.59 s, long jump 5.88 m, high jump 1.68 m).

Radiologically slight irregularities of the outline and the structure of the lateral femoral condyle (Figs. 8, 9).

In MRI there is a slightly uneven cartilage surface in the dorsal part of the condyle and a certain thinning. No cartilage defects. No joint effusion.



Fig. 4 Defect filling with cancellous bone

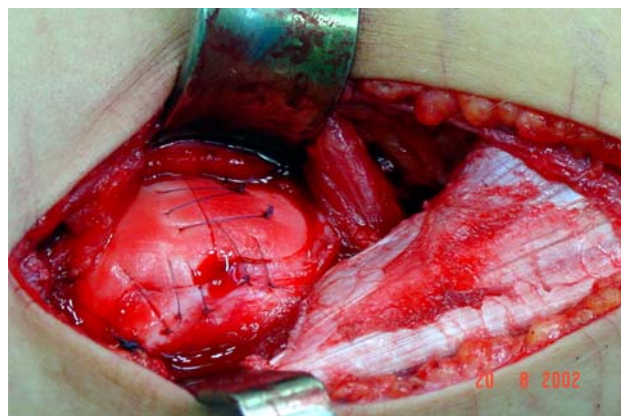


Fig. 5 Posterior and lateral cartilage sutures

Discussion and conclusions

The case shows that cystic osseous lesions can be caused by a large unstable osteochondral flake fracture. The formation of cysts was probably related to joint fluid jets directed into the cancellous bone under weight-bearing—in analogy to the formation of subchondral ganglia and osteoarthritic cysts or else the formation of metaphyseal cysts in Perthes' disease (de Sanctis and Rondinella 2000).

The removal of all the reactively altered bone, filling of the defect with healthy cancellous bone, solid fixation of the torn and partly severed cartilage by interrupted sutures with 5-0 Coated Vicryl (Dhawan and Hospodar 1999) and a comprehensive aftercare with gradual increase of range-of-motion and weight-bearing have led to a more than satisfactory mid-term result.

To our knowledge the diagnosis and successful treatment of an unstable (flapping) osteochondral flake of the lateral femoral condyle causing cystic alterations of the underlying bone has not been described before (Cain and Clancy 2001; Biau and Schranz 2005; Mashoof, Scholl et al. 2005; Mbubaegbu and Percy 1994; Schillians, Baltzer et al. 2001; Strauss, Nelson et al. 1984; Taitsman, Frank et al. 2006).

The mechanism of injury is probably similar to that in a Hoffa or Busch fracture (isolated tangential fracture of the dorsal part of the femoral condylus) (Biau and Schranz 2005; Heuschen, Gohring et al. 1994; McDonough and Bernstein 2000).

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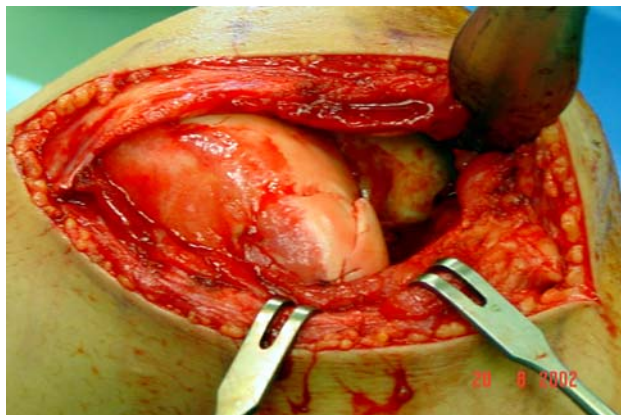


Fig. 6 Anterior approach: anterior margins of the osteochondral flake

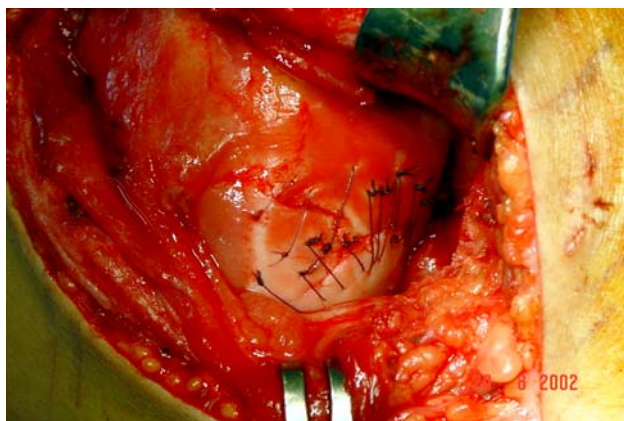


Fig. 7 Anterior cartilage sutures



Fig. 8 After 4 ½ years only minor irregularities of the outline and structure of the lateral femur condyle

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Fig. 9 After 4 ½ years only minor irregularities of the outline and structure of the lateral femur condyle

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Fibrin/HA/ β -TCP composite in use of benign bone defects and tumorlike lesions in children and adolescents

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Keywords Bone substitute, Hydroxyapatite, β -Tricalciumphosphate, Fibrin sealant, Biomaterial

Introduction

For the therapy of large bone defects from bone diseases such as benign bone tumors or tumorlike lesions the use of autologous spongiosa is still the most common and effective treatment. But obtaining spongiosa is limited and infection rate harvesting bone from the iliac crest is up to 7% in the literature. As an alternative synthetic biomaterials such as hydroxyapatite (HA) or beta-tricalciumphosphate (beta-TCP) have been in clinical use in different combinations for several decades. The ideal bone substitute biomaterial has to be biocompatible, resorbable and osteoinductive. The use of biomaterials such as HA and beta-TCP in combination with fibrin sealant represent a new and promising approach. It was examined whether Fibrin/HA/ β -TCP composite is an alternative to autologous bone graft in the therapy of benign bone defects and tumorlike lesions in children and adolescents.

Method

In a clinical study bone defects resulting from benign tumors and tumorlike lesions in 21 patients have been treated with a HA/beta-TCP

granular biomaterial (TricOs[®], Baxter) in combination with diluted fibrin sealant (5 IU/ml) (TissuCol[®], Baxter). Patients were of age 8–19 years (mean 13.7 years). Bone defects treated included 4 benign tumors and 17 tumorlike lesions of varying entity. The size of bone defects ranged from 2 to 35 cm³ (mean 12.5 cm³). Time of follow up was 12–24 months. X-ray analysis has been performed postoperatively, after 6 weeks, 3, 6 and 12 and 24 months. High-resolution MRI was performed in selected cases after 12 months to evaluate the bone defect filling and biomaterial biodegradability of the implanted material.

Results

Data of X-ray and analysis of MRI showed a complete filling of the bone defects in all patients after 24 months. Postoperative fractures were not observed and no revision surgery had to be performed. There was no total resorption of biomaterial after 24 months as determined by X-ray and MRI. TricOs[®] material in combination with diluted fibrin sealant has shown to be easy to handle for the surgeon, eliminating the risk of donor site morbidity and infection for the patient. The time of surgery can be reduced.

Conclusion

Fibrin/HA/ β -TCP composite is a safe and easy to handle bone substitute biomaterial. There was no total resorption after 24 months. Long-term clinical follow up and histological examinations have to evaluate the resorbability of the material and bone formation.

Estimation of patient dose and associated radiogenic risks from limb lengthening

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Introduction

Limb lengthening needs serial X-ray investigations to follow the lengthening process and callus formation. The objective of this study was to quantify the ionizing radiation exposure during lengthening treatment and to estimate the risks associated with this exposure.

Methods

Fifty-three patients with straight lengthening procedures and no simultaneous angular deformity corrections between 1990 and 1998 were included. Average lengthening was 4.8 cm (range 3.0 to 12.5 cm). The field size and the tube voltage of all X-rays and the fluoroscopy time during surgery were registered. According to the tables of conversion factors of organ doses from technical parameters of typical radiographic techniques of the GSF National Research Center for Environment and Health, the cumulative organ dose of each patient was estimated. These estimated cumulative organ doses were corrected by direct dose measurement with thermo luminescence dosimeters. The site of the lengthening (femur or tibia), age of the patients, complications, amount of lengthening, healing index and other factors affecting the duration of the lengthening procedures were analyzed.

Results

The average cumulative organ dose was 3.1 mS (range 0.2–17.7 mS) for a straight lengthening procedure. The average organ dose per centimeter lengthening was 0.7 mS/cm (range 0.03–5.9 mS/cm). The doses of tibia patients (0.3 mS/cm) were significant lower ($p < 0.000$) than the doses of the femur patients (1.1 mS/cm). Age of the patients, complications during lengthening, amount of lengthening and healing

index were no significant factors to increase or decrease the radiation dose exposition per centimeter lengthening.

Conclusions

This data may be used to estimate the dose of patients undergoing lengthening of the lower limb. X-ray exposition of the population caused by natural, civilian and medical sources leads to an estimated dose exposition of 3.55 mS per year in Germany. According to our data 12 cm lengthening of the tibia and 3 cm lengthening of the femur will double this exposition. Although the average patient exposure during a limb lengthening procedure is tolerable, femur lengthening contributes considerable cumulative organ doses.

Management of hinge abduction in Legg–Calve–Perthes Disease

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Keywords Legg–Calve–Perthes Disease, Hinge abduction, Arthrodiastasis, Salvage procedure

Purpose

A good hip movement is one prerequisite for successful containment therapy in LCPD. In cases of persistent loss of the joint mobility a hinge abduction may be detected with impingement of deformed femoral head and acetabular roof. The purpose of this retrospective study was to evaluate a treatment option in this condition.

Materials and methods

During 8/2000–10/2006 we have seen 14 patients, 9 boys and 5 girls (1× double side affection) with hinge abduction in LCPD and persistent restriction of hip motion. Patient age at the first examination in our institution was 9.5 [7.5...13.5] years. Seven hips were classified as Herring B and 8 as Herring C type. Hinge abduction was proven clinical, radiological and by dynamic ultrasound examination.

If we could not achieve a better ROM under conservative conditions (one week hospital stay) the patient was treated in the following manner:

1. Arthrography and hyperbaric hydraulic joint mobilisation under general anaesthesia
2. Parallel tenotomia of adductor muscles with arthrodiastasis in extension and abduction
3. Retention in maximal abduction in plaster cast
4. Prolonged analgesia with PDC/PCA
5. Start of physiotherapeutic exercises at first day after intervention
6. Containment operation as second step after achievement of improved ROM

Results

We achieved an increase of ROM in 13 patients as prerequisite for the following containment operation (11× IVO + Salter's Osteotomy, 3× IVO and 1 IVO + triple osteotomy). After follow up of 3 [0.5...6] years there was a continuous improvement of ROM and patient satisfaction. Radiographic assessment demonstrated a restoration of containment with significant reduction of femoral head extrusion and widening of superior joint space. This was in contrast to former treatment results with cheilectomy as a salvage procedure and higher rate of worse outcome. In one case (female, age 13 at diagnosis of hinge abduction) with non-compliance we saw a recurrent deterioration of ROM and pathologic incongruence.

Conclusion

Loss of motion is one important risk factor in patients with LCPD. Continuous observation is necessary to avoid adduction contracture and following incongruence of the joint. In these group of late onset LCPD patients with hinge abduction sign different treatment options with various results are reported in the literature (arthrodiastasis with external fixator, cheilectomy or later valgisation). The above mentioned treatment strategy offers the possibility for stepwise restoration of joint mobility as a prerequisite for following containment therapy during growth. It provides the chance of hip remodelling in patients with late onset LCPD. This can prevent further progression of a prearthrotic deformity and early loss of function.

Infection associated with permanent implant in small children - Interdisciplinary approach in treatment of two cases

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Keywords Implant associated Infection, Congenital scoliosis, Expansion Thoracoplasty

Introduction

Application of permanent metal implants used to be rare in children, but in the past few years there has been growing use of vertical expandable titanium rib (VEPTR) implants for expansion thoracoplasty and correction of congenital scoliosis. The most outstanding benefit is gradual correction with stimulation of spinal and thoracic growth. VEPTR implants are designed to remain in situ throughout childhood and serial re-operations for gradual lengthening are needed. One of the most severe complications in this procedure is infection due to often delicate soft tissue covering. There is only few data on treatment of infection associated with permanent implant in small children.

Methods

Two cases of implant-associated infections are reported; one caused by coagulase-negative staphylococci, the other by methicillin-resistant *Staphylococcus aureus* and multi-resistant gram-negative rods. Both cases were treated with implant retention using an algorithm proved to be effective in treatment of prosthetic joint infection [NEJM 351: 1645, 2004]. In both patients soft tissue situation at revision surgery was grossly defective, requiring temporary wound covering with vacuum dressing. Surgical treatment strategy consisted of a multi-stage approach with serial debridements and secondary wound closure by local muscular flaps. Medical treatment consisted of a three months course of a rifampin-containing antibiotic combination. Follow-up was prospectively performed using defined clinical, laboratory and radiological criteria.

Results

In both patients infection could be controlled without replacing the index implants. The children were clinically and microbiologically free of infection after 18 months. Functional and radiological course were not impaired using this treatment strategy.

Conclusions

This is the first report describing a treatment strategy with implant retention for infection associated with permanent implant in small children.

Kinderorthopädie 2007 in Düsseldorf, 04.05.-05.05.2007

Abstract: Kinderorthopädie 2007 in Düsseldorf, 04.05.-05.05.2007: Arthroscopic bankart repair in adolescents using suture anchors: indication, technique and results

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Aim

Arthroscopic bankart repair using suture anchors is a very effective treatment of shoulder instability in adults. The purpose of this retrospective study was to investigate the role of this procedure in adolescent patients suffering from posttraumatic, anterior shoulder instability. We present data of 16 patients, who were treated between 2004 und 2006 in our hospital.

Materials and methods

We retrospectively reviewed 16 patients with traumatically induced anterior shoulder instability. Arthroscopic stabilization in the sense of bankart repair using biodegradable suture anchors was performed (average 28 weeks after first occurrence of shoulder dislocation). In each case surgery was followed by a standardized physiotherapeutic program. The average follow-up time was 8 months. Functional outcomes were measured using Rowe's score. Rates of redislocation, range of motion, subjective complaints and level of current standing in sports athletes were noted.

Results

There were 16 male patients, one female patient with an average age of 16 years (age range 13–18 years). The cause of trauma resulting in anterior shoulder dislocation was sports in 9 patients (4× handball, 3× judo, 1× wrestling, 1× volleyball), in 7 cases the cause was an accident (bicycle, school). No complications had to be noticed for the operative procedures. Rowe's score for the investigated study group was postoperatively at an average of 89 points. There were 2 redislocations in 2 patients. Range of motion was unlimited in all patients. Subjective acceptance of treatment was very high. In 6 athletic adolescents the level of sports performance was on the same niveau as before the trauma.

Conclusion

Arthroscopic bankart repair using suture anchors is a demanding procedure, but for the well-trained arthroscopic surgeon it is safe and simple to perform. Our results show, that very good results can be achieved. There is a low complication and redislocation rate. We conclude that arthroscopic bankart repair using suture anchors is a very effective treatment of anterior shoulder instability in adolescent patients.

Minimally invasive correction of posttraumatic deformities of the upper extremity during childhood and adolescence

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Introduction

Posttraumatic deformities exceeding the corrective potential of adjacent physal growth or repetitive joint dislocations often require surgical therapy. Although it has become quite clear that a preventive strategy in the timing of the corrective surgery, i.e. before irreversible joint destruction can occur, is mandatory, there is still some debate about the optimum timepoint for surgery and the choice of surgical techniques as most studies in this field only comprise very few patients.

Materials and methods

Between 1/2005 and 12/2005, 51 patients with a posttraumatic deformity were treated operatively at our institution, 46 patients had a deformity of the upper extremity. In most cases a minimally invasive approach using subperiosteal osteotomy and external fixation was used. Using exemplary cases (persistent radial head dislocation, posttraumatic radioulnar synostosis, extension deformity post distal forearm fracture, and flexion deformity post supracondylar humerus fracture) our regimen concerning indication, operative technique and timing of surgery is described.

Results

We choose an early timepoint for surgery in all cases ($n = 46$) to avoid sequelae of the injury, to prevent deformities from becoming more complex, and to achieve free function. These treatment goals were achieved in all cases by one operative procedure, metal removal not counted. In two cases (4%) we observed postoperative complications in the form of pin-tract infections following external fixation. Both infections could be managed conservatively. Functional results after a median follow-up interval of 12.3 ± 3.1 months were rated as excellent or good in all cases using visual analog scales evaluating for pain, cosmesis, and overall patient satisfaction, and functional tests evaluating range of motion.

Conclusions

Posttraumatic deformities during childhood and adolescence should be treated as early as possible, pre-school children included. A “wait-and-see” strategy in cases where the deformity obviously exceeds corrective potential of the patient is never helpful. Contrary to popular belief it can even lead to a more complex deformity or complications such as joint incongruencies. In all cases followed upon in this study we were able to reach at least a clear improvement of function, in most cases even a complete restitution ad integrum with high patient and parent satisfaction by using child-adapted, thus minimally invasive surgical techniques.

Charcot joint disease of the infant's foot in congenital insensitivity to pain: case reports of three patients

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Introduction

Hereditary sensory and autonomic neuropathy (HSAN) is a heterogeneous group of inherited disorders of the peripheral nervous system. The Congenital Insensitivity to Pain Syndrome with Anhidrosis (HSAN Type IV) is characterized by the absence of temperature and pain sensation but intact touch perception. The disease is present from birth and may be inherited in an autosomal recessive pattern. The orthopaedic manifestations include repetitive traumatic fractures due to the lack of pain, which may end in a Charcot joint. A review of the surgical treatment of three patients suffering from congenital insensitivity to pain with Charcot arthropathy of the foot and ankle is presented.

Patients and methods

From 2002 to 2005, three female patients aged 2, 3 and 12 years were admitted to our hospital with painless swellings of the foot. In two cases a fracture of the first metatarsal bone, in one case fractures of the heel, talus and tibia were presented. Pathological fractures and osteomyelitis were excluded in histological and in laboratory tests. The medical histories showed recurrent fever attacks, self-mutilation and anhidrosis. In all three cases surgical treatment with excisions and fracture stabilization with bone grafting was performed as well as conservative treatment with protective orthoses was advised. Diagnostic evaluation was made by electrophysiologic and genetic

testings, thermography, nerve biopsy, MRI, CT and continuous X-rays.

Results

At the time of first presentation all patients showed fractures in the forefoot or hindfoot region with consecutive callus hypertrophy. One girl needed osteosynthesis with bone grafting of the first metatarsal bone. One patient with fractures of the calcaneus, talus and tibia developed an ulceration due to a calcaneus spur. Excision of the bone spur and skin defect was performed. In the third case osteomyelitis was suspected which could not be affirmed histologically and biochemically. All three patients showed radiological progression of Charcot joint destruction. In one case the ipsilateral knee was also affected. Protective orthotic management was applied to the patients. At time of follow-up all of them presented unimproved swellings of the foot and ankle as well as progressive Charcot joint deformities. No therapeutical approach could achieve complete recoveries.

Discussion

Neuropathic osteoarthropathy of the foot is well known in paraplegics, syringomyelia, meningomyelocele and diabetics. Charcot joint complications within congenital insensitivity to pain are rare disorders and less common. Accordingly, the number of false diagnosis and improper surgical management is high. Optimum treatment is based on early recognition of the disease and adequate prevention. To date a consensus of standardized surgical and conservative treatment does not exist.

Integration of gait analysis in therapy outcome studies in children with spastic cerebral palsy

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Keywords Cerebral palsy, Children, Gait analysis, Outcome, Therapy study

Introduction

Modern “Goldstandard”—Therapy Studies in spastic cerebral palsy (CP) children integrate standardized and validated outcome tools. The development of gait analysis offers quantitative measurements, but the global description and decision making in patients need also functional evaluation and quality of life analysis. Economic aspects may also influence the decision making.

The purpose of our study was to analyse the contribution of gait analysis compared to validated clinical measurements in three different treatment groups.

Materials and methods

A total of 183 children with spastic cerebral palsy were included in a prospective study according to following inclusion criteria: spastic cerebral palsy, walking with or without assistive device, 6–18 years old, no comprehension or behavioural deficit, no dystonia, written consent from children if possible and parents.

All patients were classified according to the Gross Motor Function Classification System (GMFCS) and their Sagittal gait pattern (Rodda et al.). Outcome tools were: Gillette Gait Index (GGI), based on three-dimensional gait analysis maximal 12 months before and minimum

9 months after therapy; functional modification based on the Gross Motor Function Measure (GMFM) and ten-level Gillette FAQ; Quality of Life evaluation in children and adolescents were based on a self- and proxy-based generic questionnaire, the Vécu et Santé Perçue de l'Adolescent (VSP-A). Three treatment groups were documented: (a) Physiotherapy, (b) Botulinum Toxin and (c) Surgery and the results based on the included outcome tools compared before and after treatment.

Results

Analysis of the diplegic patients ($N = 160$, Age: 11.05 ± 3.22) showed significant correlations in the three treatment groups between severity of motor disability according to GMFCS, GGI, Gillette FAQ and GMFM.

In Therapy Group B (GGI -34% , GMFM DE $+5\%$, Gillette $+0.44$ Level) and C (GGI -42% , GMFM DE $+6\%$, Gillette $+0.77$ Level) improvement was observed during the observation period.

Discussion

Our prospective study shows a global evaluation concept in spastic cerebral palsy children. Integration of gait analysis offers precious information to complete results of validated functional outcome measures. Inclusion of subjective quality of life analysis is essential in the therapy decision making but has to be considered separately using specific criteria.

This study furnishes a baseline for the integration of validated outcome tools to prepare further multi-center controlled therapy studies. These studies are necessary to show efficiency of new therapy concepts in cerebral palsy based on the criteria of "Evidence-based Medicine"